

Claims

1. A method of cooling an electronic component, the method including the following steps:

providing an electronic component to be cooled;

arranging a porous material to be able to receive heat from the electronic component; and

removing heat from the porous material as a result of vaporisation of a coolant from the porous material, wherein the coolant is delivered in pulses,

whereby a temperature gradient is generated that causes heat to flow from the electronic component to the porous material, resulting in the electronic component being cooled.

2. A method according to claim 1, wherein the method includes a step of delivering the coolant directly onto the exterior surface of the porous material.

3. A method according to claim 1 or claim 2, wherein the step of delivering the coolant is performed by spraying the coolant.

4. A method according to any preceding claim, wherein the method includes a step of delivering coolant into the interior of the porous material.

5. A method according to any preceding claim, wherein delivery of the coolant is controlled by a control unit in dependence on a temperature dependent signal received by the control unit.

6. A method according to any preceding claim, wherein delivery of the coolant is controlled by a control unit in dependence on the power driving the electronic component.

7. A method according to any preceding claim, wherein the coolant is a gas at ambient temperature and pressure.
8. A method according to any preceding claim, wherein the coolant is delivered at a temperature below ambient temperature.
9. A method according to any preceding claim, wherein the coolant is stored under pressure.
10. A method according to any preceding claim, wherein the porous material and the coolant have properties such that the porous material is able to retain coolant.
11. A method according to any preceding claim, wherein the porous material has a porosity of between 4 and 40 pores per centimetre.
12. A method according to any preceding claim, wherein the porous material comprises a solid foam.
13. A method according to any preceding claim, wherein the porous material has a thermal conductivity that in at least one direction is higher than $50 \text{ Wm}^{-1}\text{K}^{-1}$.
14. A method according to any preceding claim, wherein the electronic component is part of an electronic device, wherein at least part of the electronic device is porous and forms at least part of the said porous material.
15. A method according to any preceding claim, wherein the electronic component is a semiconductor device.

16. A method as claimed in claim 15, wherein the semiconductor device includes a substrate, wherein said substrate includes pores.
17. A method according to any preceding claim, wherein the electronic component is a radiation emitting component arranged to emit electromagnetic radiation having a wavelength in the range of 200nm to 10000nm.
18. A method according to any preceding claim, wherein at least a portion of the electronic component is cooled to below ambient temperature.
19. An apparatus for cooling an electronic component, the apparatus including a porous material, a source of coolant, and a dispenser arranged to deliver, in use, coolant, in pulses, from the source of coolant into contact with the porous material, the apparatus being arranged such that in use the porous material is able to receive heat from an electronic component and such that in use such an electronic component is able to be cooled as a result of the vaporisation of coolant from the porous material.
20. An apparatus according to claim 19, wherein the apparatus includes a heat spreader for conducting heat from the electronic component to the porous material.
21. An apparatus according to claim 19 or claim 20, wherein the apparatus includes a control unit for controlling the cooling of the component during use of the apparatus.
22. An apparatus according to claim 21, wherein the control unit is arranged so as to prevent operation of the electronic

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component if a sensed temperature is above a threshold temperature.

23. An apparatus for cooling an electronic component, the apparatus including a porous material, and a dispenser arranged to be able to deliver, in use, coolant, in pulses, from a source of coolant into contact with the porous material, the apparatus being arranged such that in use the porous material is able to receive heat from an electronic component and such that in use such an electronic component is able to be cooled as a result of the vaporisation of coolant from the porous material.

24. An electronic device including an electronic component arranged to be cooled by means of a method according to any of claims 1 to 18 or by means of an apparatus according to any of claims 19 to 23.

25. A light emitting apparatus including a high intensity light emitting semiconductor component, wherein the semiconductor component is arranged to be cooled by means of a method according to any of claims 1 to 18 or by means of an apparatus according to any of claims 19 to 23.

26. A kit of parts including a porous material and a heat spreader, the kit of parts being arranged to be suitable for use in a method according to any of claims 1 to 18 or for use in an apparatus according to any of claims 19 to 23.